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(54) Taxi meters

(57) A transport data processor suitable for use as a taxi meter comprises a micro processor 1 connected to a programmable read only memory 2 and a non-volatile random access memory 3. An input/output control 4 provides interfacing between peripherals, such as a data radio or a printer, and the micro processor. A display panel 9 displays information routed by the micro processor. Such information can comprise charges and/or dispatch messages received through the input/output control 4. To allow for time dependence of changes in tariff values a clock 13 is connected to the micro processor 1.

In this way an integrated transport data processor is provided capable of communication between a base and a mobile unit in addition to linking a metering device, credit card or similar reader printer with the base through a radio link.

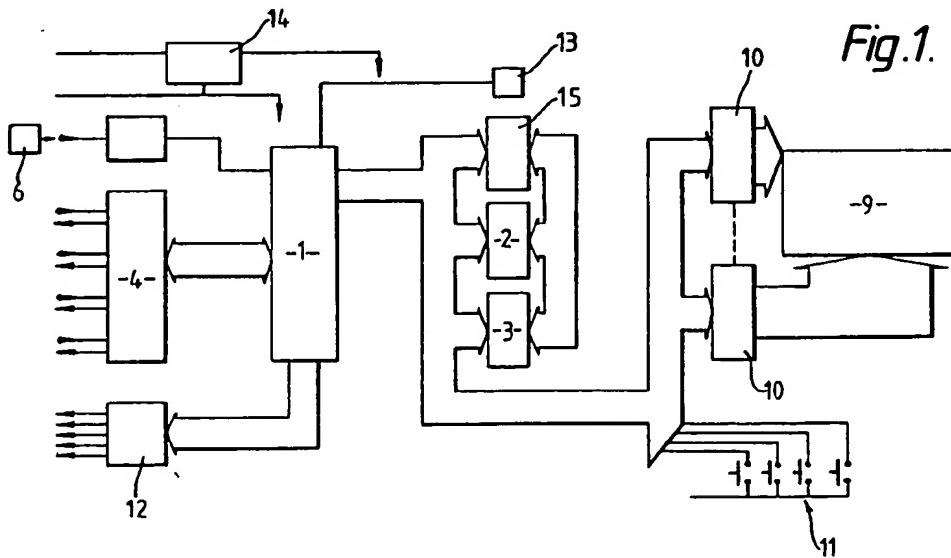


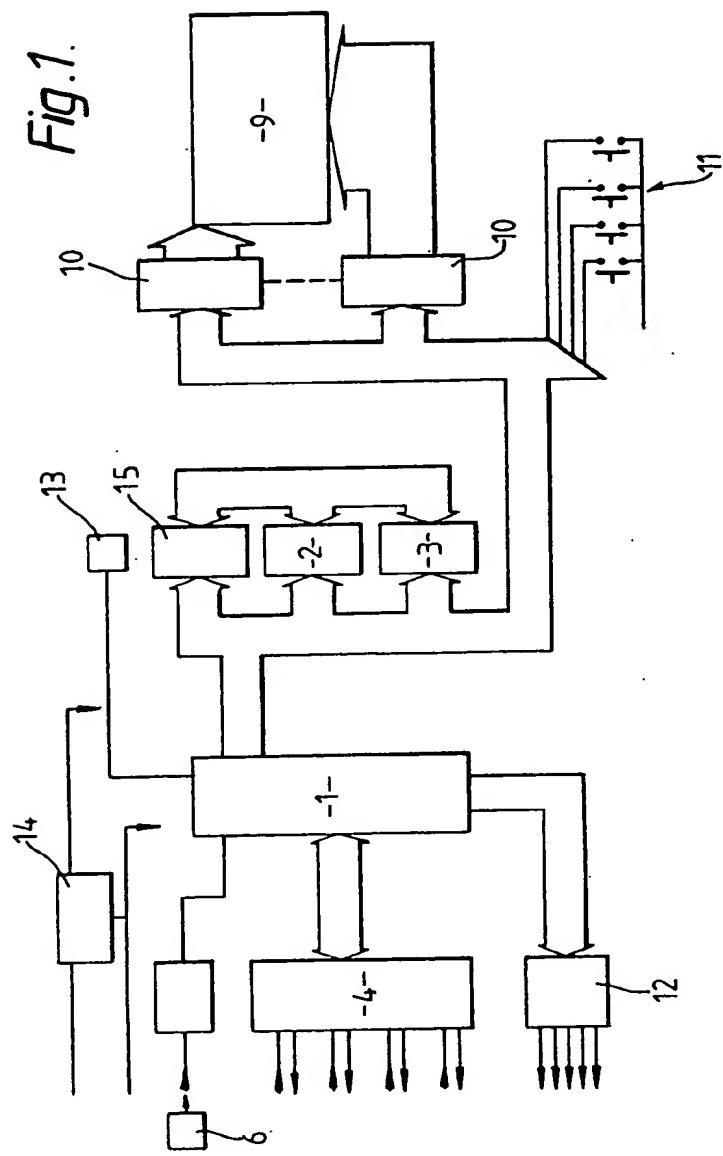
Fig.1.

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Fig. 1.



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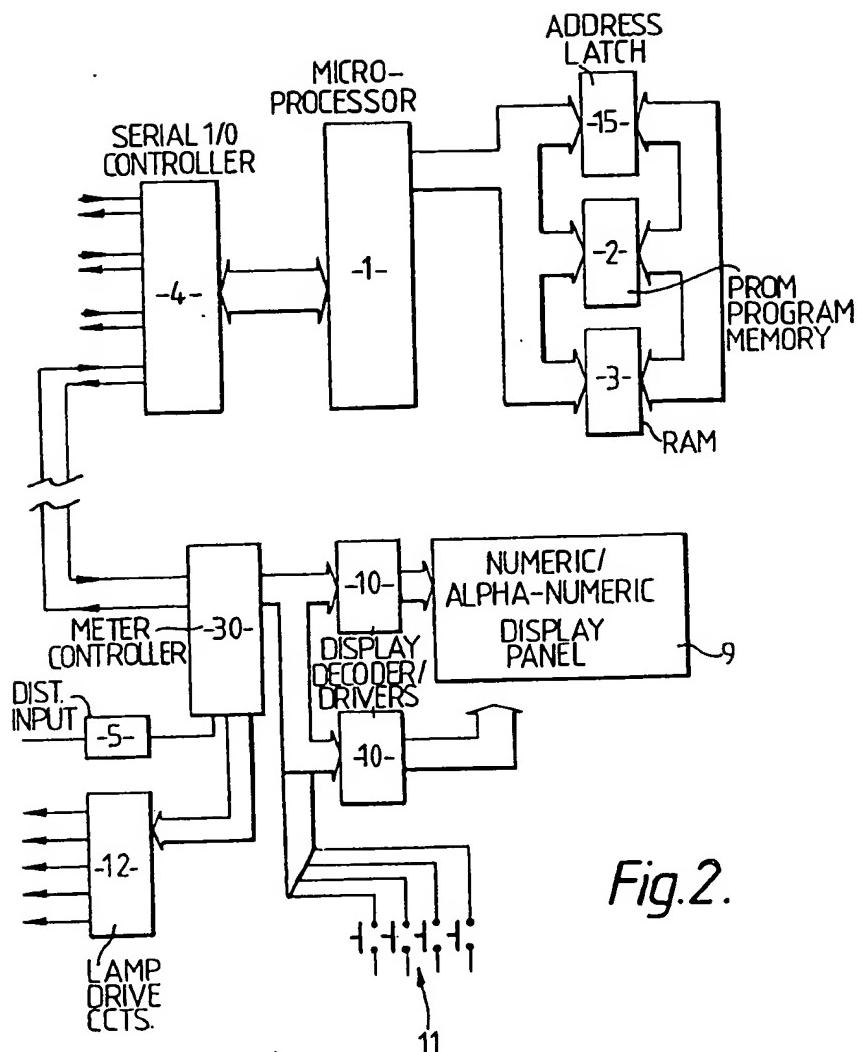
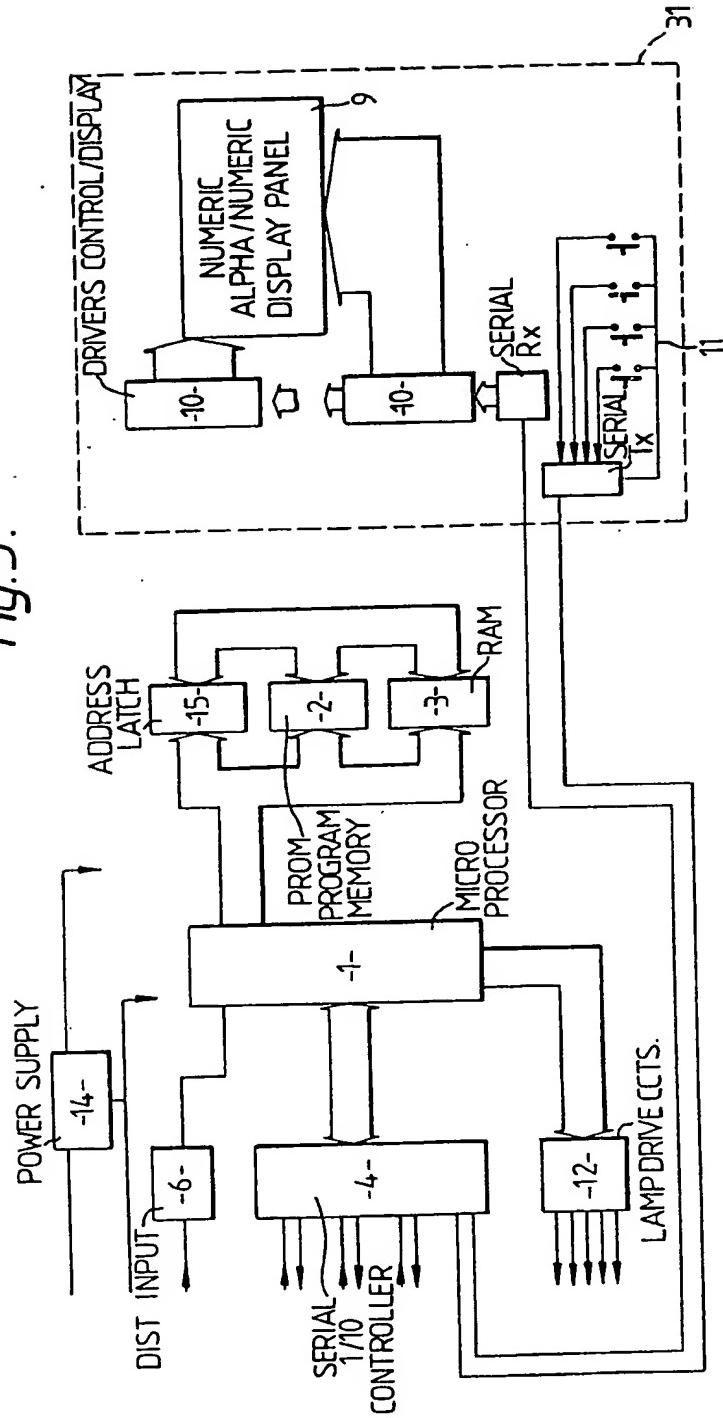


Fig.2.

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Fig. 3.



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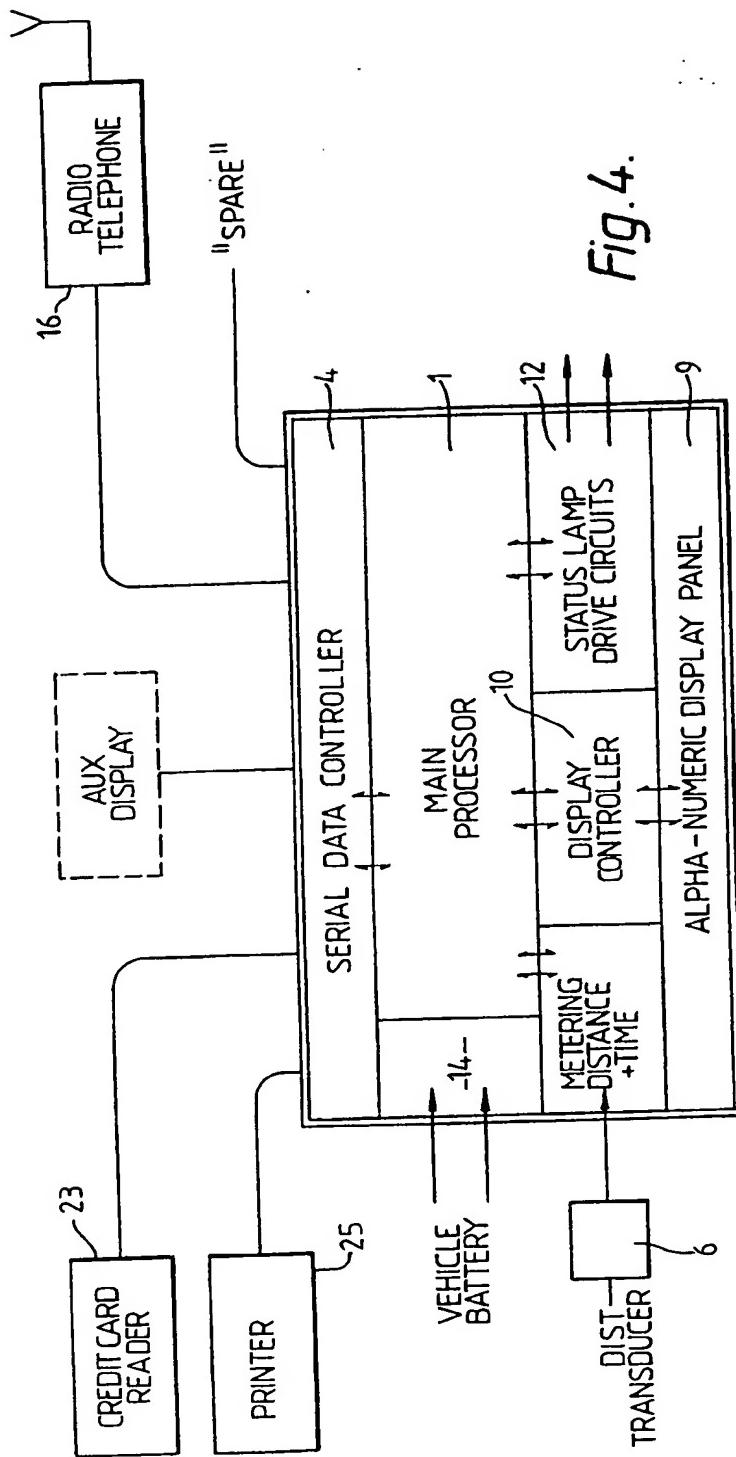


Fig. 4.

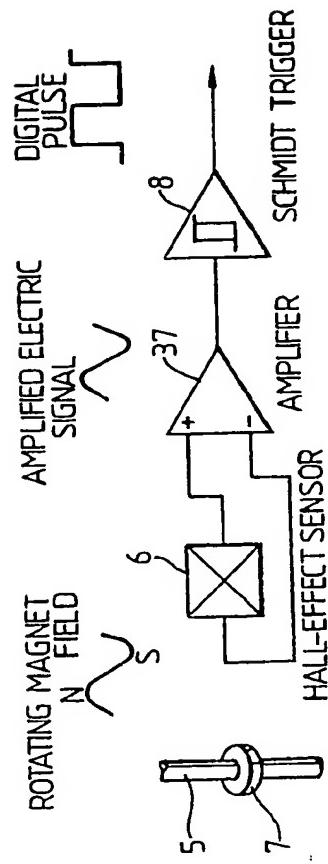


Fig. 8.

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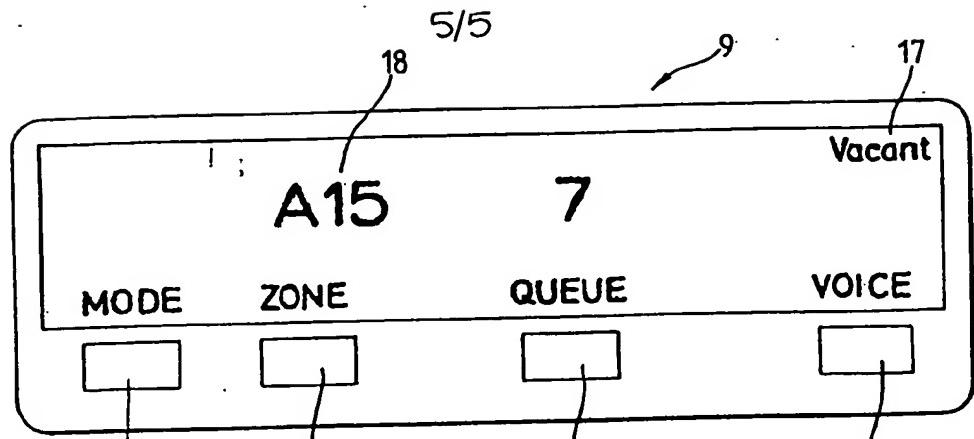


Fig. 5.

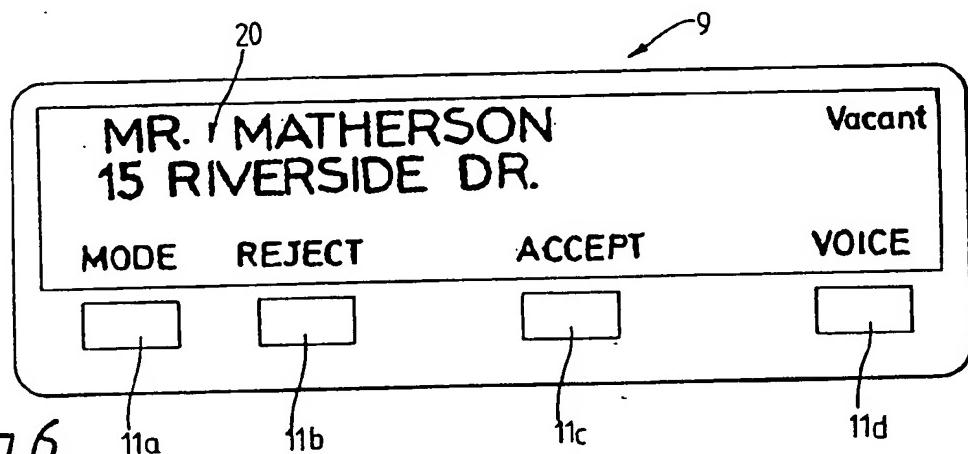


Fig. 6.

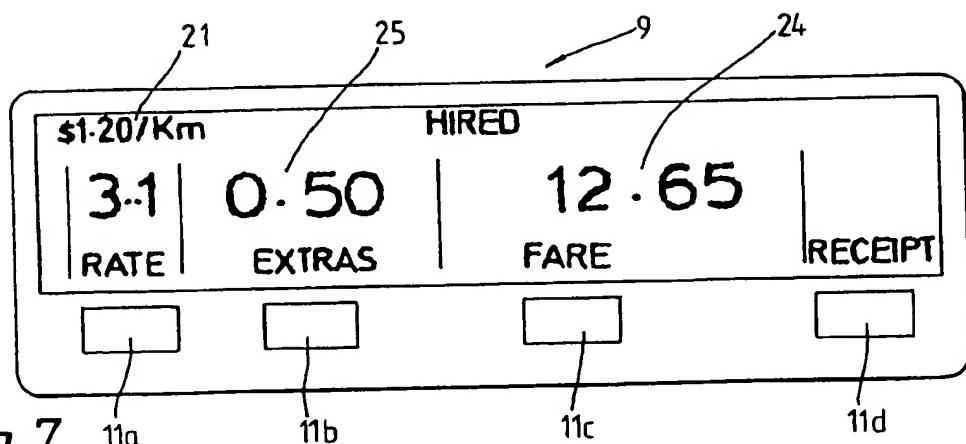


Fig. 7.

SPECIFICATION

Improvements in or relating to taxi meters

5 This invention relates to transport data processes.

In the passenger transport industry there is a growing need for increased efficiency flexibility and versatility whether the vehicle be a 10 taxi a mini bus or a bus. Passengers demand faster response times and cheaper fares.

It is an object of the present invention to provide a transport data process which will go at least some distance towards meeting the 15 foregoing desiderata or which will at least provide the public with a useful choice.

Accordingly the invention consists in a transport data processor comprising processing means, non volatile storage means, data communication means and display means, said 20 processing means being arranged to process and control the transfer of data, including fixed and running data, between said data communication, said storage means and said 25 display means, including the calculation of charges and the direction of required data to said data communication means and/or said display means as appropriate.

In the preferred form of the invention a 30 transport data processor or metering device is provided which includes a processing means, interfacing means, a non-volatile storage means and a display means. The processing means processes or controls data passing to 35 and from peripheral units including units such as a printer, credit card reader, data radio, base computer, storage means and the display means all of which are wellknown in themselves. The processing means also performs 40 all the calculations involving transactions and fare metering. The storage means provides retention of both fixed and running data.

Fixed data refers to information which is altered relatively infrequently such as fare scheduling data and the like and which can be organised for optimum flexibility. Running data refers to data relating to the operation of the vehicle such as the distance travelled and other data which is based on a particular trip.

50 The display means includes a fare readout, a readout suitable for displaying messages such as may be held in the data storage means or which may be received from other peripheral units such as dispatch information, or district status information, credit card type, meter status or tariff.

The interfacing means preferably are provided in the form of a plurality of serial communication ports through which operating 60 instructions, data and/or messages can be passed and directed to the required peripheral or to the processing means. The routing of such information is preferably controlled by the processing means. The preferred form of 65 the invention will be described by reference to

a taxi meter communicating directly with peripheral units but the invention is useable as a vehicle mounted processing means in a separate housing controlling peripherals as described above plus a control/display panel for driver of the operation and display of the taxi fare. The invention can be modularized in one of a number ways, including constructions in which the peripherals are contained within a 75 single housing unit with the central unit or attached to that central unit.

Where the system is to be used in a mass transport system such as a bus or parcel system, it may be impractical or undesirable 80 to display charges as they accrue. In such circumstances by passing a charged card or a prepaid card through a card reader peripheral at the beginning of the trip and again upon alighting i.e. at the end of the trip the individual transaction can be recorded and payment either automatically debited or charged. Tickets and receipts can likewise be automatically issued.

In computing a fare to be charged a transport data process for example a taxi meter 90 uses as a basis distance travelled and waiting time incurred. Waiting time is normally charged only when the speed of the vehicle is less than a predetermined limit. The distance 95 information is provided through the speedometer drive system sensed by a suitable transducer or in the case of electronic speedometers the distance information can be determined directly from the vehicle wiring. The 100 meter uses the distance and timing circuits to compute the fare in accordance with the fare structure in force for that particular hiring. This structure can be held in the fixed data 105 memory or in the event of special fare structures can be communicated through a radio link from a base computer to the taxi meter. Under normal circumstances however the particular fare structure will be read from the 110 fixed data memory and used to compute the fare. The selection of the fare structure, that is the tariff number, could be selected manually, or automatically in accordance for example with the time of day, nature of the fare, district or zone. This selection and/or the 115 application of additional charges can be made from a base station through a radio link. Likewise where the tariff is required to change during a trip due to entering a new zone or entering a time of day for which different 120 tariffs are applicable the selection can be made automatically. Furthermore the tariff structure can be enhanced to accommodate a plurality of passengers where individual passengers can share a taxi and travel at rates 125 cheaper than individual rates. This can be implemented by dividing each tariff rate into a number of subrates, each subrate being related to the number of passengers sharing the taxi at that particular time. Thus with the 130 combination of fixed data memory and data

communication to a base computer control or variation of the fare structure and the simplicity of operation are great.

- One preferred form of the invention will now be described with reference to the accompanying drawings in which, Fig. 1 is a block schematic diagram of one preferred form of transport data processor according to the invention,
- 10 *Figure 1* is a block schematic diagram of one preferred form of transport data processor according to the invention,

Figure 2 is a block diagram as in Fig. 1 including a second micro processor to perform

15 some of the functions of the meter,

Figure 3 is a block diagram as in Figs. 1 and 2 wherein the display and control panel constitutes a remote unit,

20 *Figure 4* is a schematic diagram of mobile equipment including a taxi meter and its peripherals.

Figures 5, 6 and 7 show a display panel for use with the transport data processor of the invention in different modes of operation, 25 and

Figure 8 is a block diagram representing a Hall Effect sensor for use in one form of the invention.

30 *Figure 8* is a block diagram representing a Hall Effect sensor for use in one form of the invention.

Referring to Fig. 1 a taxi meter is shown comprising a micro processor 1, a programmable read only memory (PROM) 2, a random access memory (RAM) 3 and a connection means, such as an input output control (IOC) 4. The micro processor 1 carries out the required computations of the taxi meter under the control of the programme contained in the 35 PROM 2. RAM 3 is a non-volatile memory storing both fixed data and running data. This memory can be in the form of an electrically alterable read only memory, a battery back CMOS memory or other equivalent device.

40 IOC 4 provides interfacing between peripherals such as above set forth and in particular provides an input/outport port for example a serial port through which the fare schedule can be passed or controlled for 45 example, through a radio data link which may utilise an existing radio telephone link to a base computer.

50 Distance information is obtained from the speedometer cable 5 by means of a HALL effect sensor 6 which detects the rotating magnetic field of a small magnetic collar 7 attached to the cable 5. The Hall Effect sensor preferably passes a signal to an amplifier 37, and then to a schmidt trigger 8 so as to 55 provide the required digital pulse to the micro processor 1.

The fare to be paid is displayed on a display panel 9 which in its simplest form can be a row of seven segment digital displays but in 60 the preferred form of the invention where it is

desired also to display messages on the display panel 9 a dot matrix panel is preferred. This can take the form of an LCD panel or an LED alpha numeric display with suitable decoder driver chips 10.

- 65 In addition to displaying fare this panel 9 can display accumulated trip related data as well as messages to identify the display parameter, meter mode or status tariff and switch labels and information can also be displayed relating to the fare or fares and passenger or passengers.

Taxi dispatch information and zone queuing information can be displayed on the panel 9 70 also.

75 Operation may be effected by four push button switches 11 by reference to Fig. 1 being labelled 11a 11b 11c 11d in Figs. 5 to 7. The function of the switches 11a to 11d is dependent upon the mode of the meter that is to say when hired the switches may be assigned the functions each of the switch "rate" "extras" "fare" and "receipt" for example. When vacant the operation may relate to job 80 dispatching and the switches may be assigned the functions "mode" "accept" "reject" "totals" and in a search mode the switches may be assigned the functions "mode" "queue" "zone" and "schedule."

90 95 A capacity is provided to drive indicator lamp circuit 12 external to the meter and depending upon the local requirements these can include "engaged," "for hire," "stopped," "tariff," "number of passengers," "penal rates" and "courtesy light" for example.

100 To allow for automatic tariff changes at night and on holidays and also to provide dated receipts a real time device such as clock 105 13 which is controlled by the micro processor 1 and is powered desirably by auxiliary battery. Other functional blocks shown on the schematic diagram of Fig. 1 include a power supply 14 and an address latch 15 as may be 110 required.

115 Inputs to the IOC 4 can include for example, engine data, such as engine speed, fuel usage, temperature and fault parameters. The software can process this to provide information on vehicle operating conditions and performance.

120 As the regulations pertaining to taxi meters differ from country to country and because the particular function of the system depends largely on its software rather than the hardware hereinbefore described the software is written preferably in a high level language so as to be easily changed to meet any requirements and in the next part of the description on arbitrary taxi trip will be described in order to explain the operation of the mobile system.

125 With the taxi initially vacant and the driver seeking a fare or passengers the driver is able to interrogate the taxi queues in his area 130 through the control panel as shown at Fig. 5

- to seek data relating to the various zones or ranks which are able to be displayed on his panel through the radio link 16 in Fig. 2 which links with the base computer.
- 5 With the meter initially showing vacant at 17 and the zone selected at 18 by operation of button 11b the base computer knows that that particular taxi is available and also which zone the taxi is in.
- 10 When a job passenger or fare is allocated to this taxi the address is displayed as shown at 20 in Fig. 6 and the driver can accept or reject the job by pushing the appropriate button 11b or 11c indicated in Fig. 6. Assuming that the driver accepts the job and drives to the address required. When the passenger enters the car the mode button 11a is pressed to select the metering mode and the fare is started on the appropriate tariff see Fig. 7 which is indicated at 21. The tariff can be set manually or automatically using information within the meter that is to say stored in the RAM 3 or can be set automatically using information received from the base computer through the radio link 16.
- In certain places discount fares are available to special categories of passengers for example the elderly and the handicapped. In these circumstances the appropriately magnetically coded card provided by the passenger is entered into the card reader 23 and the transaction adjusted and recorded accordingly. The card reader 23 can be caused to accept standard credit cards and also credit cards appropriate to that taxi operation also. On line validity checking is of course possible. If manual operation is required the fare is started by using the fare button 11c in Fig. 7 and the fare is displayed as it accrues at 24 and extras can be incremented by the use of button 11b so that the extras are shown at 25 in the manner presently known. At the end of the trip the fare to be paid can be either charged to an account using a card in the credit card reader 23 or paid by cash. A receipt can be issued from the receipt printer 25 and can include for example data time trip reference number fare paid and the like. Upon clearing the fare from the meter another job can be requested or issues on the queue situation can be interrogated again as above described.
- For efficient management of taxi fleets drivers can use specially coded magnetic cards to sign on and off thus the base knows at all times how many and which taxis are operating and who the driver is. Metering can be disabled and this is done if required for example this can be achieved by inhibiting the operation of the meter until the driver using a magnetic card in the card reader 23 signs on. An acknowledgement from the base to the radio link 16 signals the beginning of the driver's shift and the meter is accordingly enabled and enters the for hire mode automatically. The driver can sign off in a similar manner and thus signing off can be used to initiate a printout of running totals for that shift. These totals can be transmitted to the base and it would be possible to use this information to for example calculate the driver's wages.
- If desired a prepaid card system can be used whereby the fare is automatically discounted from a passenger's credit by the base computer through information relayed through the radio link 16.
- A printout of the fare schedule on the display and/or the printer could be instigated by pressing an appropriate button 11a to 11d. This would read the fare schedule from the fixed memory 3 and display in it a suitable form. Where the fare schedule required updating from time to time in accordance for example with local regulations the new fare schedule data can be transmitted from the base station through the radio link 16 to for example taxis either individually or collectively in a suitably coded manner in order to update the data held in the fixed data memory 3. An alternative method is to access the data passed through the rear connector or a serial port with a programming unit. In addition to shift totals non-erasable continuous totals can be logged and displayed or printed.
- Data from the taxi base by use of the base computer and the radio link 16 can be used to control the taxi meter to for example start and stop the fare, change the tariff, increment extra charges, implement special rates, request operating data, cancel a fare, disable and enable the meter operation, discount the taxi fare, acknowledge valid credit cards, access running totals or other data held in the meter, update the fare schedule data, and alter or synchronise the time of day clock 13.
- In the construction shown in Fig. 2 the main processor 1 is freed from the tasks of metering by the provision of a second micro computer or processor 30 which is in the form of a dedicated controller linked to the main processor 1 through the input/output controller 4.
- In the construction shown in Fig. 3 the display and control panel 9 is provided in a remote unit 31 connected to the meter through the serial input and output controller of 4.
- Fig. 4 shows in particular how the various peripheral units fit in with the meter.
- 120 Thus it can be seen that at least in the preferred form of the invention are integrated transport data processor is provided which is able to provide data communication between a base and mobile units carried on a vehicle linking a metering device, credit card or similar reader printer with the base computer through a radio link. The result at least in the preferred form of the invention is an efficient computerised system which can be easily tailored to meet the needs of any transport

- industry. Thus a metering device is provided which can be readily programmed, preferably in a high level computer language, to adapt easily to virtually any rapid transport system,
- 5 and to interface with peripherals to constitute a transport management system. The metering device also serves as a system interfacing unit, visual display panel and a fare calculating computer.
- 10 CLAIMS
1. A transport data processor comprising processing means, non volatile storage means, data communication means and display means, said processing means being arranged to process and control the transfer of data, including fixed and running data, between said data communication means, said storage means and said display means, including the calculation of charges and the direction of required data to said data communication means and/or said display means as appropriate.
2. A transport data processor as claimed in claim 1 wherein said transport data processor comprises a taxi meter.
3. A transport data processor as claimed in claim 1 or 2, wherein said data processing means processes and controls the transfer of data further including text messages.
4. A transport data processor as claimed in any preceding claim wherein said data communication means includes connection means through which peripheral equipment is connected to said processing means.
5. A transport data processor as claimed in claim 4 wherein said peripheral equipment includes one or more of a card reader, a data radio or a printer operation of said transport data processor being capable of being controlled or affected by incoming data from said card reader and/or said data radio.
6. A transport data processor as claimed in any preceding claim wherein said display means display data and messages including charges and despatch messages received through said communication means.
7. A transport data processor as claimed in any preceding claim contained in a housing and having one or more articles of peripheral equipment contained in or attached to said housing.
8. A transport data processor as claimed in any preceding claim wherein said display means comprise a dot matrix type display unit suitable for displaying fare and dispatch related date and text.
9. A transport data processor as claimed in any preceding claim wherein said display means is remotely positioned from said processing means being connected to said processing means through said communication means.
10. A transport data processor as claimed in any preceding claim wherein said display

means includes a control panel having a plurality of switches therein said switches having varying functions depending on the mode of the operation of the meter.

- 70 11. A transport data processor as claimed in claim 10 wherein said control panel is positioned remotely from said processing unit.
12. A transport data processor as claimed in any preceding claim wherein said communication means is associated with a radio data link to enable said processing means to receive data to update the fare schedule held in said storage means.
13. A transport data processor as claimed in any preceding claim wherein said data communication means receives engine data to enable said processing means to provide information on vehicle operating conditions and performance.
- 80 14. A transport data processor substantially as herein described with reference to the accompanying drawings.

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